7.1 Exercise Set

1. Determine if the ordered pair is a solution to the given non-linear systems.

a) $2x^2 - 3y = 2$ $(2, 2)$
$x - 2y = -2$

$2(2)^2 - 3(2) = 2 \quad 2(4) - 6 = 2$ ✓

$2 - 2(2) = -2$

$-2 = -2$ ✓ yes.

b) $2x^2 - 3y = 2$ $(-1.25, 0.375)$
$x - 2y = -2$

c) $x^2 + 2y = -2$ $(-2, -3)$
$-2x + y = 2$

$(-2)^2 + 2(-3) = -2 \quad 4 - 6 = -2$ ✓

$-2(-2) - 3 = 2$ ✗ no

d) $y = x^2 + 2x - 1$ $(-3, 2)$
$y = x^2 + 4x + 5$

e) $y = x^2 - 3x - 2$ $(-\frac{3}{5}, \frac{4}{25})$
$y = x^2 + 2x + 1$

$\frac{4}{25} = \left(\frac{-3}{5}\right)^2 - 3\left(\frac{-3}{5}\right) - 2 \quad \frac{4}{25} = \frac{9}{25} + \frac{9}{5} - 2$ ✓

$\frac{4}{25} = \left(\frac{-3}{5}\right)^2 + 2\left(\frac{-3}{5}\right) + 1 \quad \frac{4}{25} = \frac{9}{25} - \frac{6}{5} + 1$ ✓ yes.

f) $y = x^2 - 3x - 4$ $(3, -4)$
$y = -x^2 - 13$

2. Determine all values of h, so that the graph of the equation contains the given point.

a) $y = 2(x - h)^2 + 7$; $(3, 57)$

$57 = 2(3 - h)^2 + 7$

$50 = 2(3 - h)^2$

$25 = (3 - h)^2$

$\pm 5 = 3 - h \quad h = 3 \pm 5$

$h = 8, -2$

b) $y = -3(x - h)^2 + 6$; $(2, -42)$

c) $y = -\frac{1}{2}(x - h)^2 + 8$; $(-1, -10)$

$-10 = -\frac{1}{2}(-1 - h)^2 + 8$

$-18 = -\frac{1}{2}(-1 - h)^2 \quad \pm 6 = -1 - h$

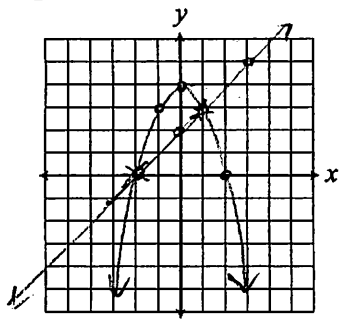
$36 = (-1 - h)^2 \quad h = -1 \pm 6 = 5, -7$

d) $y = \frac{1}{3}(x - h)^2 - 4$; $(-2, 71)$

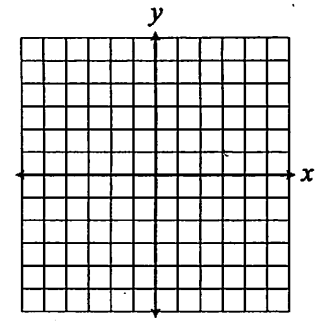
3. Solve the system by graphing.

a) $y = 4 - x^2$
$y = x + 2$

(-2, 0) (1, 3)

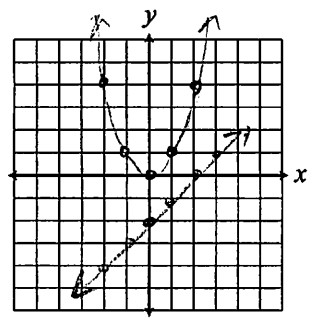


b) $y = x^2 - 1$
$y = 2x - 2$

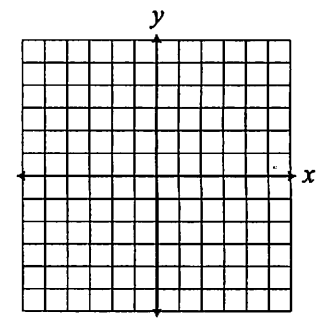


c) $y = x^2$
$y = x - 2$

$\varnothing$



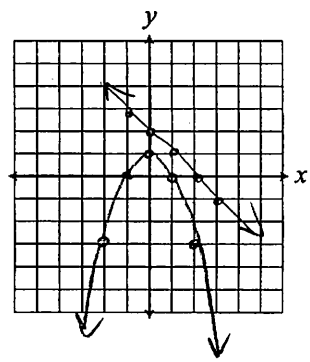
d) $y = (x + 2)^2$
$y = -2x - 4$



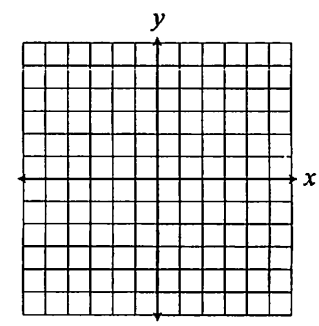
e) $y = -x^2 + 1$
$x + y = 2$

$y = -x + 2$

$\varnothing$



f) $y = \frac{1}{2}(x - 1)^2 - 4$
$2x + y = -4$



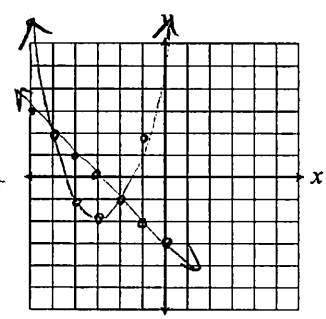
g) $y = x^2 + 6x + 7$
$x + y = -3$

$y = -x - 3$

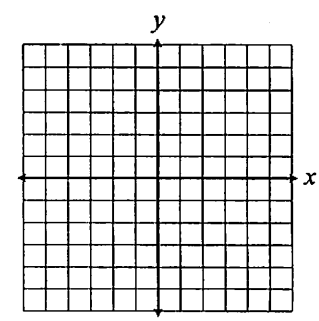
$y = (x+3)^2 - 9 + 7$

$y = (x+3)^2 - 2$

(-5, 2) (-2, -1)



h) $y = x^2 - 4x + 5$
$x - y = -1$

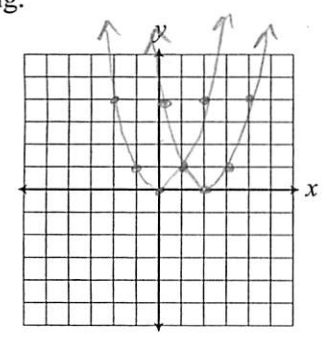


1. Solve the system by graphing.

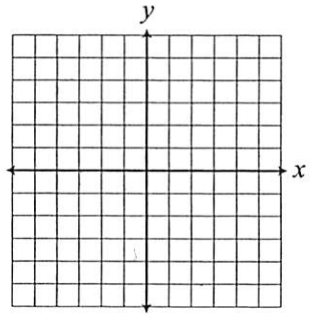
a) $y = x^2$
$y = x^2 - 4x + 4$

$y = (x-2)^2$

(1, 1)

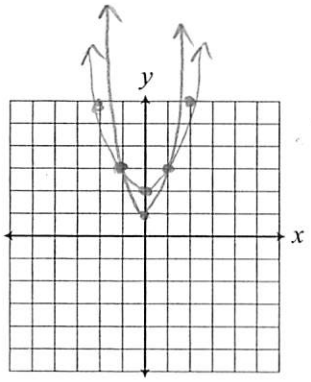


b) $y = -x^2 + 3$
$y = x^2 + 1$

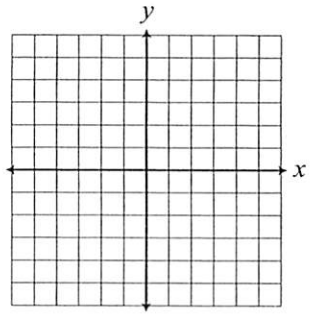


c) $y = x^2 + 2$
$y = 2x^2 + 1$

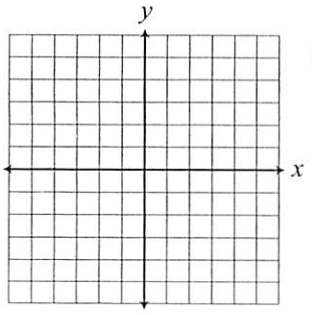
(−1, 3) (1, 3)



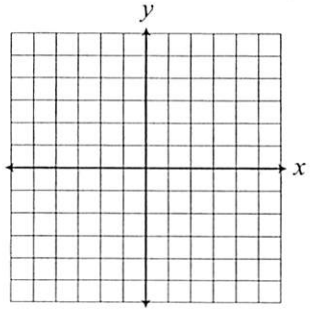
d) $y = \frac{1}{2}(x-1)^2 - 4$
$y = -\frac{1}{2}(x-1)^2 + 5$



e) $y = 3x^2 + x - 4$
$y = 3x^2 - 8x + 5$



f) $y = -x^2 + x - 1$
$y = x^2 + 2x - 2$



7.2 Exercise Set

1. Find all real solutions of the system of equations.

a) $2x^2 - y = 1$
$y = 5x + 2$

$2x^2 - (5x+2) = 1$
$2x^2 - 5x - 3 = 0$
$(2x+1)(x-3) = 0$
$x = -1/2, 3$
$y = 5(-\frac{1}{2}) + 2$
$y = 5(3) + 2$
$(-1/2, -1/2)(3, 17)$

b) $x^2 - y = 3$
$y = 3x + 7$

c) $2y = x^2$
$y = x - \frac{1}{2}$

$2(x - \frac{1}{2}) = x^2$
$2x - 1 = x^2$
$0 = x^2 - 2x + 1$
$0 = (x-1)^2$
$x = 1$ $y = 1 - \frac{1}{2} = \frac{1}{2}$
$(1, 1/2)$

d) $x^2 + y = 4$
$2x + y = 1$

e) $3x^2 - 10y = 5$
$x - y = -2$
$x + 2 = y$

$3x^2 - 10(x+2) = 5$
$3x^2 - 10x - 20 = 5$
$3x^2 - 10x - 25 = 0$
$(3x+5)(x-5) = 0$
$x = -\frac{5}{3}, 5$
$y = -\frac{5}{3} + 2 = \frac{1}{3}$
$y = 5 + 2 = 7$
$(-5/3, 1/3)$ $(5, 7)$

f) $2x^2 - 3y = 2$
$x - 2y = -2$

g) $x^2 + 2y = -2$
$-2x + y = 1 + 2x$

$x^2 + 2(1+2x) = -2$
$x^2 + 4x + 4 = 0$
$(x+2)^2 = 0$
$x = -2$
$y = 1 + 2(-2) = -3$
$(-2, -3)$

h) $y = 1 - x^2$
$x + y = 2$

i) $y = x^2 - x$
$y = 2x$

$2x = x^2 - x$
$0 = x^2 - 3x$
$0 = x(x-3)$
$x = 0, 3$
$y = 2(0) = 0$
$y = 2(3) = 6$
$(0, 0)$ $(3, 6)$

j) $y = x^2 - 6x$
$y = x - 12$

1. k) $y = x^2 + 8x - 10$
$y = 3x + 4$

$3x+4 = x^2+8x-10$
$0 = x^2+5x-14$
$0 = (x+7)(x-2)$
$x = -7, 2$
$y = 3(-7)+4 = -17$
$y = 3(2)+4 = 10$

$(-7, -17)(2, 10)$

l) $x^2 = y$
$2x - y = 1$

m) $x^2 + y = 9$
$3x + 2y = 16$

$y = 9 - x^2$

$3x + 2(9-x^2) = 16$
$3x + 18 - 2x^2 = 16$
$0 = 2x^2 - 3x - 2$
$0 = (2x+1)(x-2)$
$x = -1/2, 2$

$y = 9 - \left(\frac{-1}{2}\right)^2 = \frac{35}{4}$
$y = 9 - (2)^2 = 5$

$\left(\frac{-1}{2}, \frac{35}{4}\right)(2, 5)$

n) $x^2 - y = 10$
$2x - 3y = -10$

o) $y = x^2$
$x + y = 3$

$x + x^2 = 3$
$x^2 + x - 3 = 0$
$x = \frac{-1 \pm \sqrt{1-4(-3)}}{2} = \frac{-1 \pm \sqrt{13}}{2}$

$y = \left(\frac{1+\sqrt{13}}{2}\right)^2$
$y = \left(\frac{-1-\sqrt{13}}{2}\right)^2$

p) $3y - x - 3 = 0$
$y + 2x^2 - 2 = 0$

$\frac{1-2\sqrt{13}+13}{4} = \frac{14-2\sqrt{13}}{4} = \frac{7-\sqrt{13}}{2}$

$\frac{1+2\sqrt{13}+13}{4} = \frac{14+2\sqrt{13}}{4} = \frac{7+\sqrt{13}}{2}$

$\left(\frac{-1+\sqrt{13}}{2}, \frac{7-\sqrt{13}}{2}\right)\left(\frac{-1-\sqrt{13}}{2}, \frac{7+\sqrt{13}}{2}\right)$

q) $y = x^2 - 4x + 3$
$y = 3x - 2$

r) $y = x^2 + 5x + 6$
$x - y = -12$

s) $xy = -9$
$y = -\frac{1}{2}x$

$x\left(\frac{-1}{2}x\right) = -9$
$\frac{-x^2}{2} = -9 \quad x^2 = 18 \quad x = \pm 3\sqrt{2}$
$y = -\frac{1}{2}(3\sqrt{2}) = -\frac{3\sqrt{2}}{2} \quad y = -\frac{1}{2}(-3\sqrt{2}) = \frac{3\sqrt{2}}{2}$

t) $xy = 4$
$y = 2x - 1$

$(3\sqrt{2}, \frac{3\sqrt{2}}{2})(-3\sqrt{2}, \frac{3\sqrt{2}}{2})$

2. Find all real solutions of the system of equations.

a) $y = x^2$
$y = 2x^2 + x$

$2x^2 + x = x^2$

$x^2 + x = 0$

$x(x+1) = 0$

$x = 0, -1$ $\quad y = 0 \quad (0,0)$ $\quad y = 1 \quad (-1,1)$

b) $y = x^2$
$y = 2 - x^2$

c) $y = \frac{1}{2}x^2$
$xy = 4$

$x\left(\frac{1}{2}x^2\right) = 4$

$x^3 = 8$ $\quad (2,2)$

$x = 2$

$y = \frac{1}{2}(2)^2 = 2$

d) $y = x^2$
$y = 3x^2 + 8x$

e) $y = x^2 + x$
$y = 2x^2 + 3x - 3$

$2x^2 + 3x - 3 = x^2 + x$ $\quad (-3,6)$

$x^2 + 2x - 3 = 0$ $\quad (1,2)$

$(x+3)(x-1) = 0$

$x = -3, 1$

$y = (-3)^2 + (-3) = 6 \quad y = 1^2 + 1 = 2$

f) $y = x^2 - x$
$y = 2x^2 + 2x - 4$

g) $y = x^2 + 1$
$y = 2x^2 + x - 3$

h) $y - x^2 = 0$
$x^2 - 2x + y = 6$

i) $x^2 + 3x - y - 4 = 0$
$x^2 + 2x + y - 8 = 0$

$x^2 + 3x - 4 = y$

$y = -x^2 - 2x + 8$

$x^2 + 3x - 4 = -x^2 - 2x + 8$

$2x^2 + 5x - 12 = 0$

$(2x-3)(x+4) = 0$

$x = 3/2, -4$ $\quad (3/2, 11/4)$ $\quad (-4,0)$

j) $2x^2 + y = 9$
$y - x^2 - 5x = 1$

$y = \left(\frac{3}{2}\right)^2 + 3\left(\frac{3}{2}\right) - 4 = \frac{11}{4}$

$y = (-4)^2 + 3(-4) - 4 = 0$

3. Find all points of intersection of the parabola $y = x^2 - 4x + 2$ and the x-axis.

$y=0$

$x^2-4x+2=0$

$x=\frac{4\pm\sqrt{16-4(2)}}{2}=\frac{4\pm2\sqrt{2}}{2}=2\pm\sqrt{2}$

$(2+\sqrt{2},0)\ (2-\sqrt{2},0)$

4. Find all points of intersection of the parabola $3x^2 + \frac{1}{6}x + y = 0$ and the x-axis.

5. Find all points of intersection of the parabola $y = 75x^2 - 33x + 157$ and the y-axis.

$x=0$

$y=75(0)-33(0)+157=157$

$(0,157)$

6. Find all points of intersection of the parabola $y = -0.001x^2$ and the line $y = -5$.

7. Find all points of intersection of the parabola $y = 0.0002x^2$ and the line $y = 2$.

$0.0002x^2=2$

$x^2=10000$

$x=\pm100$

$(100,2)\ (-100,2)$

8. Find all points of intersection of the parabola $y = -0.102x^2 + 7.69x - 15.3$ and the line $y = 2$.

9. Find all points of intersection of the parabola $y = 0.011x^2 - 0.522x - 0.506$ and the line $y = 3$.

10. Find all points of intersection of the parabola $y = -0.437x^2 - 6.253x + 12.3$ and the line $2x - 3y = 5$.

7.3 Exercise Set

1. Fill in the blanks.

a) The equation $x = 2$ is a boundary line when graphing the inequality $3x > 6$.

b) In graphing the inequality $x - 2y > 4$, the shaded solution would be below. the boundary line.

$x - 4 > 2y$

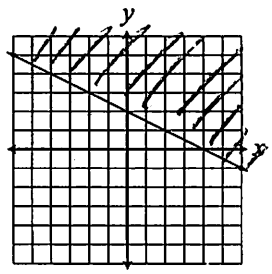
c) The boundary line in $2x + 3y \geq 6$ would be a solid. line.

d) The boundary line in $2x + 3y < 6$ would be a dashed line.

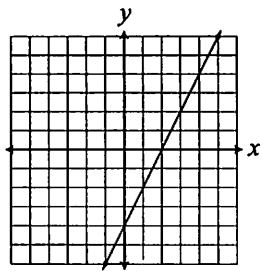
e) When using test points to determine a shaded region, never choose a point on the boundary line.

2. Complete the graph by shading the correct region.

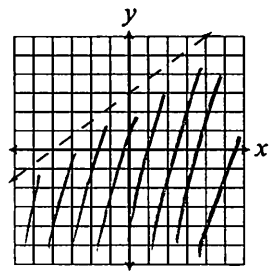
a) $x + 2y \geq 4$ $\quad y \geq -\frac{x}{2} + \frac{4}{2}$



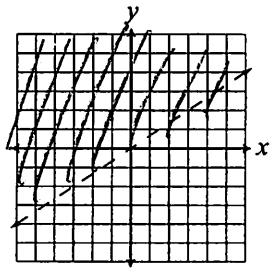
b) $2x - y \geq 4$



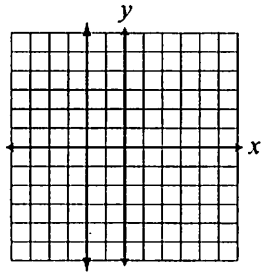
c) $-3x + 4y < 12$



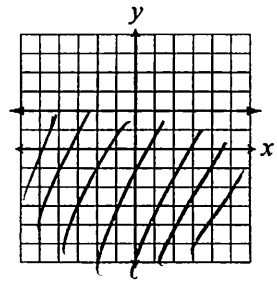
d) $x < 2y$



e) $x \geq -2$

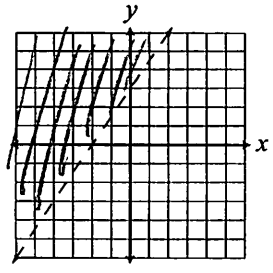


f) $y < 1$

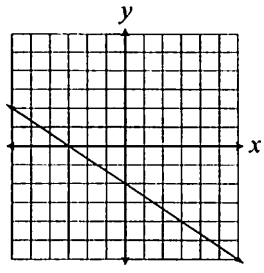


$3x + 6 < 2y$

g) $3x - 2y < -6$

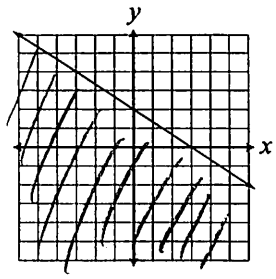


h) $-2x - 3y \geq 6$



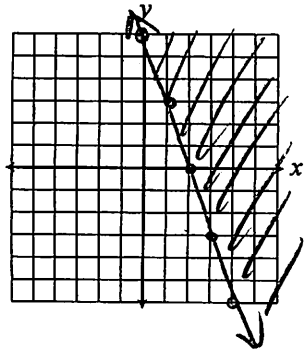
$3y \leq 6 - 2x$

i) $2x + 3y \leq 6$

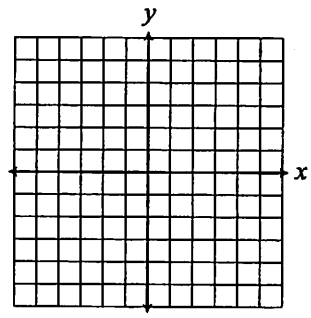


3. Graph the inequalities.

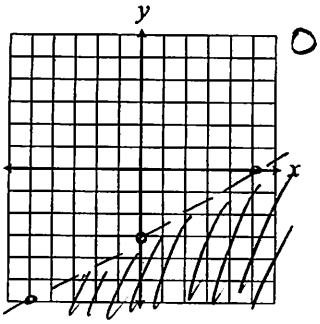
a) $3x + y \geq 6$ $y \geq -3x + 6$.



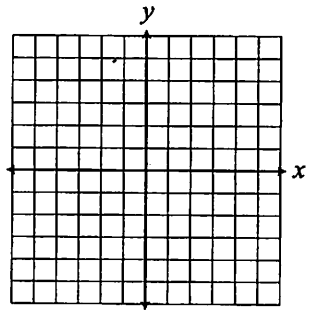
b) $2x - y < 4$



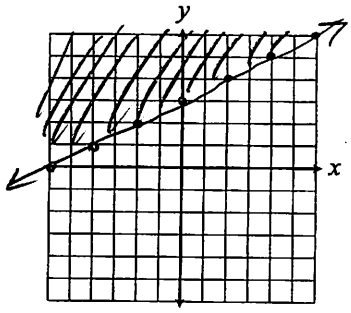
c) $0.4x - \frac{2}{3}y > 2$ $0.4x - 2 > \frac{2}{3}y$ $0.6x - 3 > y$



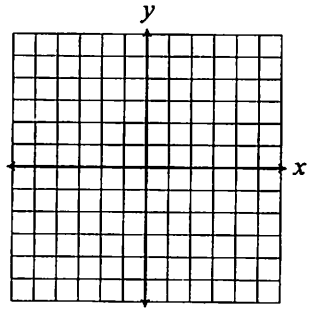
d) $\frac{1}{3}x + \frac{2}{3}y \geq 2$



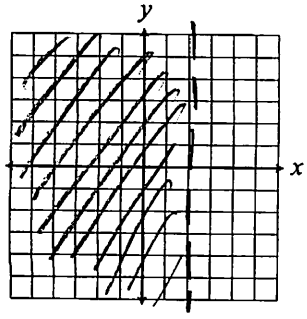
e) $y \geq \frac{1}{2}x + 3$



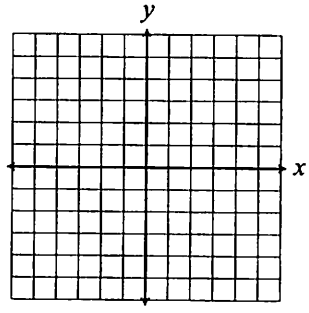
f) $y \leq -\frac{4}{3}x + 2$



g) $x < 2$



h) $y \geq -3$



4. Match the system of equations with its corresponding solution region.

a) $x - y \le 2$
$-2x + y \le -4$
$x-2 \le y$
$y \le 2x-4$
iv

b) $x - y \le 1$
$3x + y \le 3$
$x-1 \le y$
$y \le -3x+3$
v

c) $x - y \le 2$
$-2x + y \ge -4$
$y \ge x-2$
$y \ge 2x-4$
i

d) $x - y \le 1$
$3x + y \ge 3$
$y \ge x-1$
$y \ge -3x+3$
vi

e) $x - y \ge 2$
$-2x + y \ge -4$
$y \le x-2$
$y \ge 2x-4$
ii

f) $x - y \ge 1$
$3x + y \ge 3$
$y \le x-1$
$y \ge -3x+3$
vii

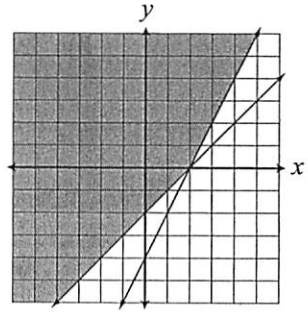
g) $x - y \ge 2$
$-2x + y \le -4$
$y \le x-2$
$y \le 2x-4$
iii

h) $x - y \ge 1$
$3x + y \le 3$
$y \le x-1$
$y \le -3x+3$
viii

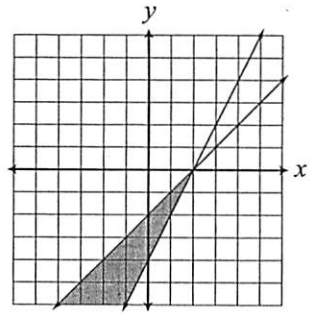
i) $-1 \le x \le 3$
$1 \le y \le 3$
ix

j) $1 \le x \le 3$
$-1 \le y \le 3$
x

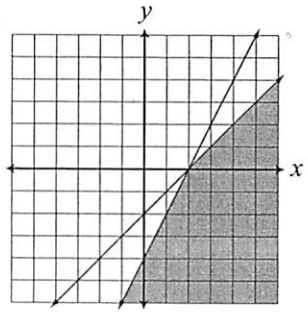
i)



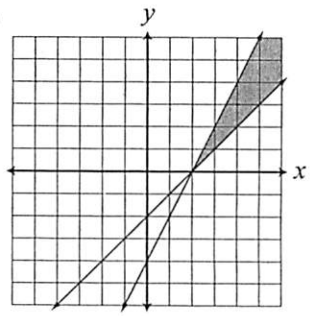
ii)



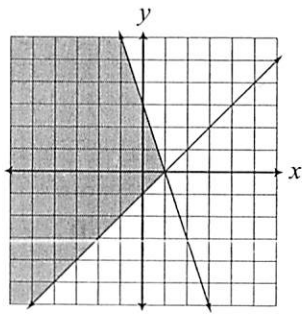
iii)



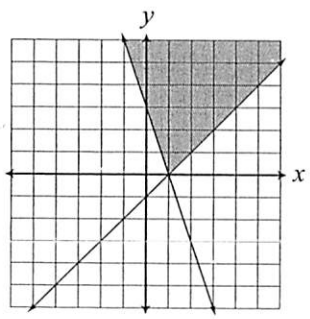
iv)



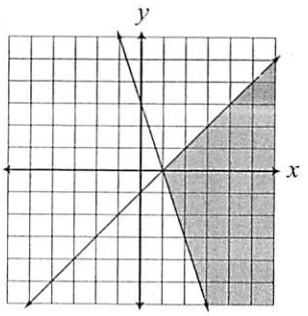
v)



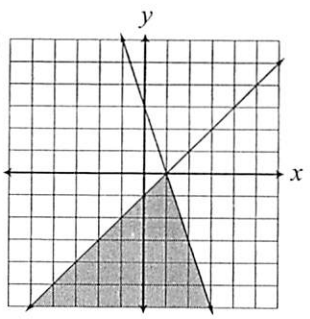
vi)



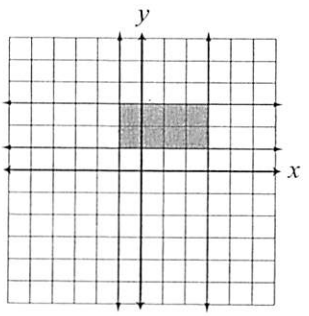
vii)



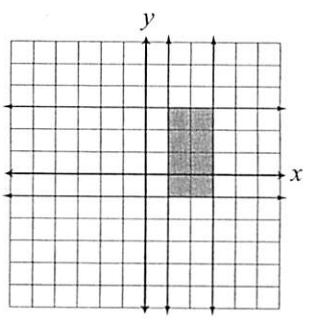
viii)



ix)

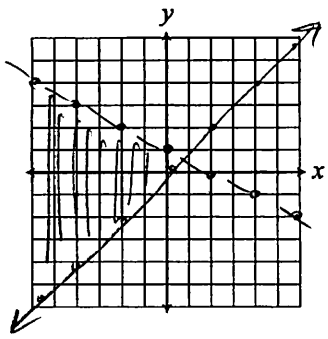


x)

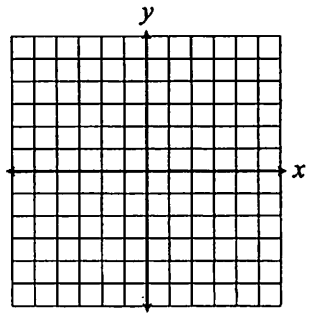


5. Graph the system of linear inequalities.

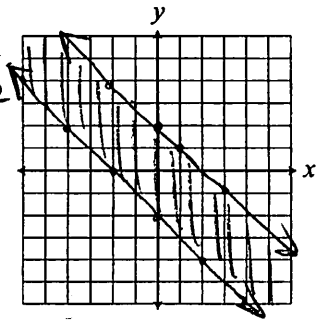
a) $y \geq x$
$2y < -x + 2$
$y < -\frac{1}{2}x + 1$



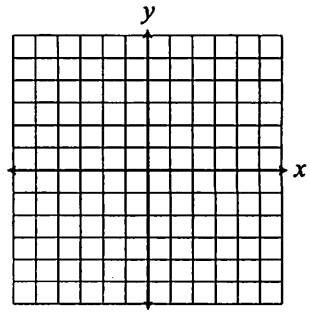
b) $x + 2y > 4$
$3x - 2y \leq 6$



c) $x + y \leq 2$ $y \leq -x + 2$
$x + y \geq -2$ $y \geq -x - 2$

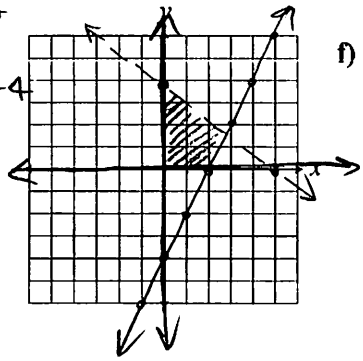


d) $y \leq x + 1$
$y \geq -x + 1$

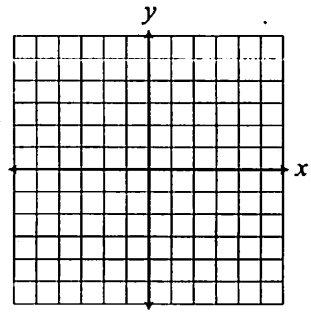


$y < -\frac{4}{5}x + 4$

e) $4x + 5y < 20$
$2x - y \leq 4$ $y \geq 2x - 4$
$x \geq 0$
$y \geq 0$

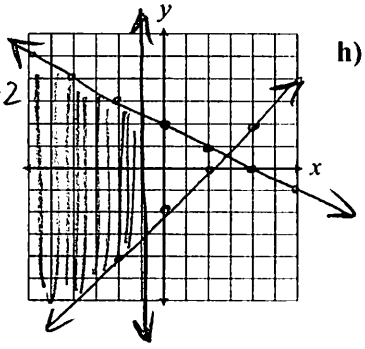


f) $x - y \geq 1$
$x - y \leq 3$
$-1 \leq x \leq 3$

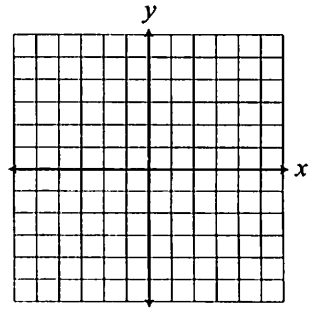


$y \geq x - 2$

g) $x - y \leq 2$
$x + 2y \leq 4$ $y \leq -\frac{1}{2}x + 2$
$x \leq -1$

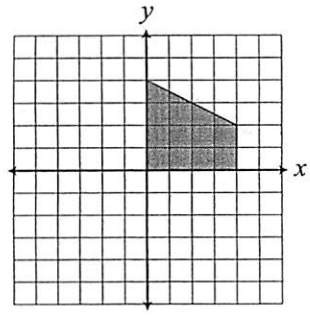


h) $x + y \leq 4$
$2x - y \geq 2$
$x \geq 0$
$y \leq 0$



6. Write a system of linear inequalities for each graph.

a)

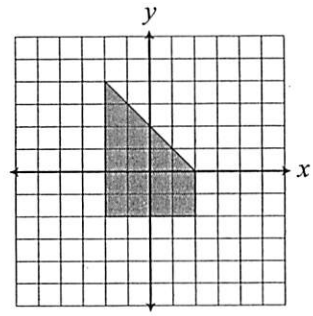


$y \leq -\frac{1}{2}x + 4$

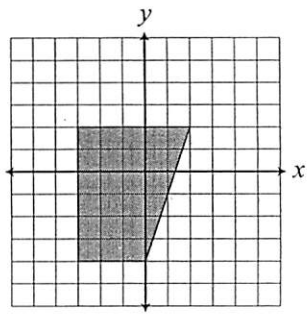
$0 \leq x \leq 4$

$y \geq 0$

b)



c)

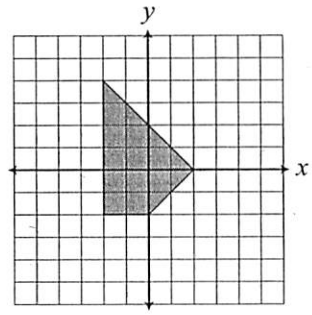


$x \geq -3$

$-4 \leq y \leq 2$

$y \geq 3x - 4$

d)



7. Write a system of inequalities with the given information.

a) The solution is in Quadrant IV

b) The solution is the y-axis.

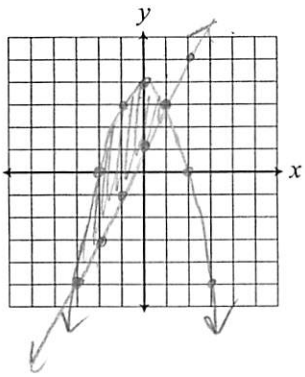
c) The solution is the negative x-axis.

d) The solution is the point $(2, -3)$

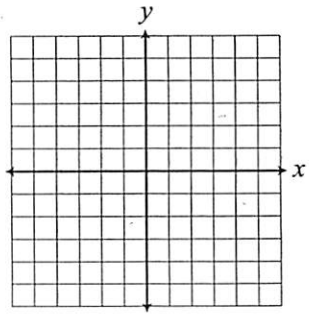
7.4 Exercise Set

1. Graph the system.

a) $y \leq 4 - x^2$
$y \geq 2x + 1$

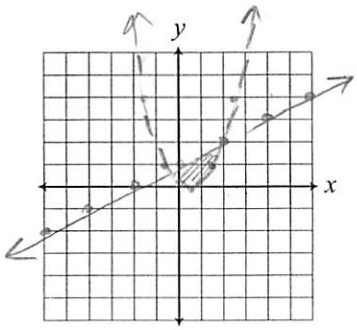


b) $y \geq x^2 - 3x + 2$
$y \geq x^2 + 2x + 1$

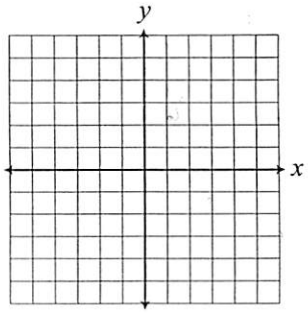


$y > (x - \frac{1}{2})^2 - \frac{1}{4}$

c) $y > x^2 - x$
$y \leq \frac{1}{2}x + 1$

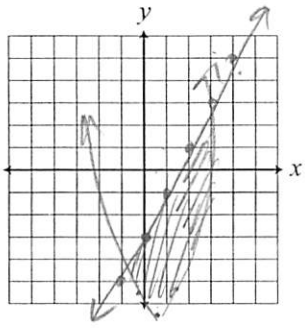


d) $y \geq x^2 - 2x - 3$
$y \geq -x + 2$

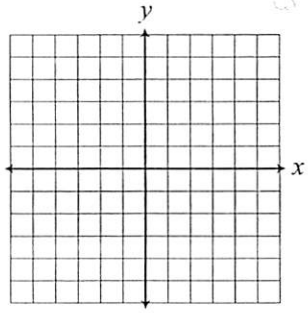


$y \geq (x - \frac{1}{2})^2 - 25/4$

e) $y \geq x^2 - x - 6$
$y \leq 2x - 3$

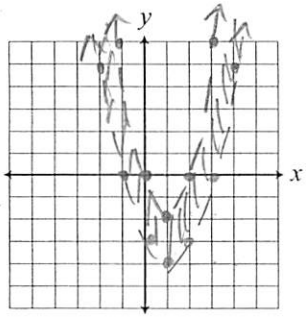


f) $y \geq x^2 - 3x - 4$
$y < \frac{1}{2}x^2 - \frac{3}{2}x$

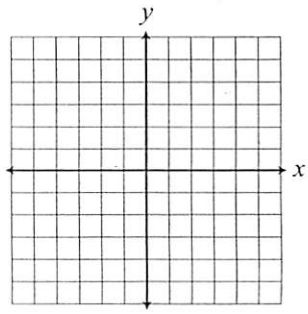


$y > (x - 1)^2 - 4$

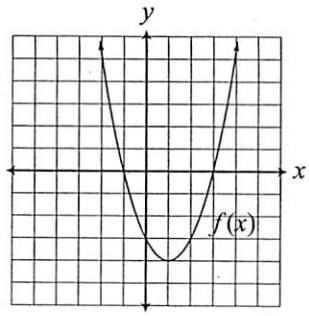
g) $y > x^2 - 2x - 3$
$y < 2x^2 - 4x$
$2(x^2 - 2x)$
$y < 2(x - 1)^2 - 2$



h) $y \leq x^2 - 1$
$y > 2x - 2$



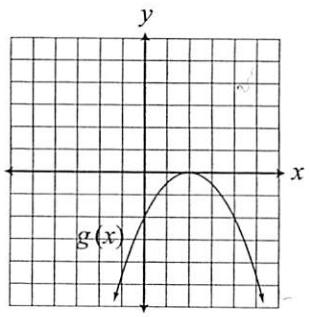
2. Refer to the graphs of the quadratic functions f, g, and h.



a) What is the solution of $f(x) = 0$? $(-1,0)\ (3,0)$

b) What is the solution of $f(x) < 0$? $-1 < x < 3$

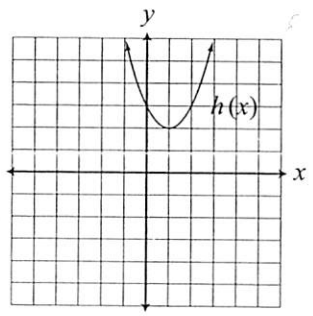
c) What is the solution of $f(x) > 0$? $x < -1,\ x > 3.$



d) What is the solution of $g(x) = 0$? $x = 2$

e) What is the solution of $g(x) < 0$? $x \neq 2$

f) What is the solution of $g(x) > 0$? $\varnothing$



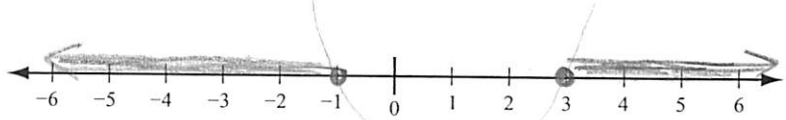
g) What is the solution of $h(x) = 0$? $\varnothing$

h) What is the solution of $h(x) < 0$? $\varnothing$

i) What is the solution of $h(x) > 0$? $\mathbb{R}$

3. Solve each of the inequalities, then graph the solution on a number line.

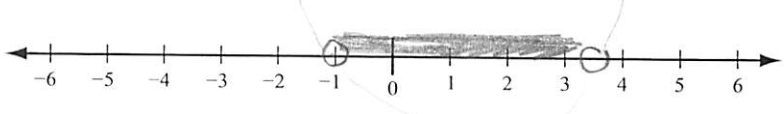
a) $(x - 3)(x + 1) \geq 0$



$x \leq -1$ $\qquad$ $x \geq 3$

b) $(x + 1)(2x - 7) < 0$

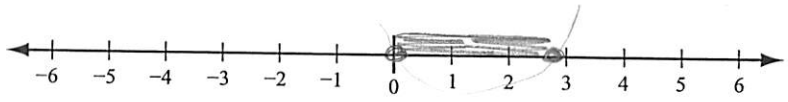
$\frac{7}{2}$



$-1 < x < 3.5$

3. **c)** $x(3x-8) \leq 0$

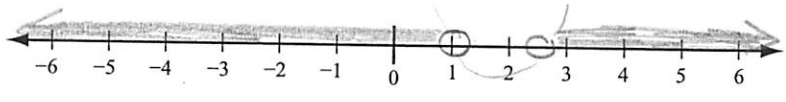
$\frac{8}{3}$



$0 \leq x \leq 8/3$

d) $(x-1)(2x-5) > 0$

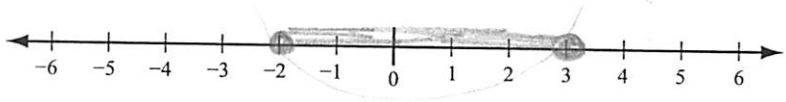
$\frac{5}{2}$



$x < 1 \quad x > 5/2$

e) $x^2 - x - 6 \leq 0$

$(x-3)(x+2) \leq 0$



$-2 \leq x \leq 3$

f) $(x-3)^2 > 0$

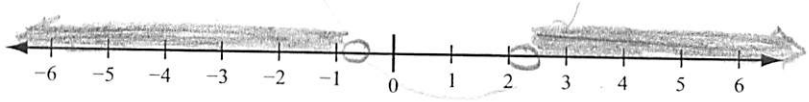
$x \in R;\ x \neq 3$

g) $x^2 - 2x - 4 \leq 0$

$x = \frac{2 \pm \sqrt{4-4(-4)}}{2} = \frac{2 \pm 2\sqrt{5}}{2} = 1 \pm \sqrt{5} \qquad 1-\sqrt{5} \leq x \leq 1+\sqrt{5}$

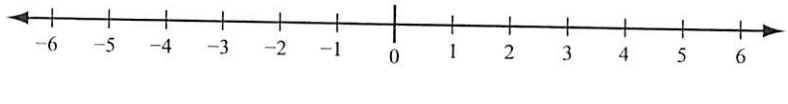
h) $2x^2 - 2\sqrt{2}x - 3 > 0$

$(\sqrt{2}x+1)(\sqrt{2}x-3) > 0$



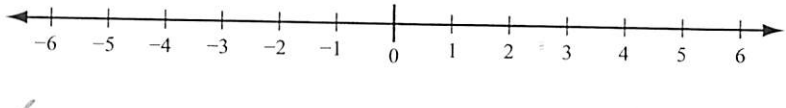
$x < -1/\sqrt{2} \quad x > 3/\sqrt{2}$

i) $2x^2 - 3x + 5 < 0$



$x = \frac{3 \pm \sqrt{9-4(2)(5)}}{2(2)} \quad \emptyset$

j) $x^2 - 2x + 4 \geq 0$



$x = \frac{2 \pm \sqrt{4-4(4)}}{2} \quad \emptyset$

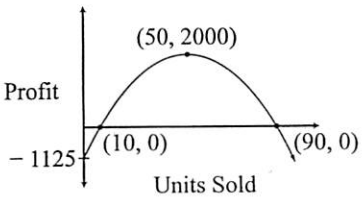
7.5 Exercise Set

1. Use the graph of the profit function to determine:

a) Business expenses $\$1125$

b) Profit interval $10 \leq x \leq 90$.

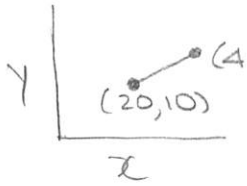
c) Maximum profit $\$2000$



2. If n is positive, then $1 + 2 + \cdots + n = \frac{n(n+1)}{2}$. For what value of n will the sum, $1 + 2 + \cdots + n$, be greater than or equal to 78?

3. A store sells two brands of computers. It stocks twice as many sets of brand X than brand Y. It must carry at least 10 computers of brand Y. There is room for not more than 60 computers. Find a system of inequalities that describes all possibilities.

$x = 24 \quad y = \frac{1}{2}x$



(20, 10)

$x + y \leq 60$.

4. A person has \$16 000 to invest in stocks and bonds, with at least \$2000 in stocks, and at least three times that amount in bonds. Find a system of inequalities that describes the possibilities of the investment.

5. A furniture manufacturer makes tables and chairs. If a table takes 20 hours of labour and a chair takes 5 hours of labour to make, find every combination of tables and chairs that can be produced by 10 workers, each working a maximum of 40 hours per week.

$= 400$ hrs. total.

(t, c)

$(0, \frac{400}{5}) = (0, 80)$

$(1, \frac{380}{5}) = (1, 76)$

$(2, \frac{360}{5}) = (2, 72)$

...

6. A city has a maximum of \$180 000 to spend on vehicles. They can get cars for \$20 000 and trucks for \$30 000. Find every combination of cars and trucks that are possible if at least two of each vehicles must be purchased.

7. A wine producer has 100 acres of land to produce grapes. It costs \$400 per acre to plant x acres of type X grapes, and \$500 per acre to plant y acres of type Y grapes. If no more than \$48 000 is available for planting, write a system of inequalities to describe the situation.

$x + y = 100$

$\$400x + \$500y \leq \$48000$

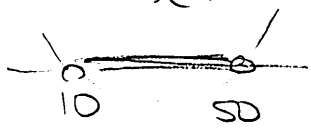
8. A rectangular dog run is to be built with 120 ft of fencing. If one side of the dog run uses the side of a barn, for what values will the width have the enclosed area less than or equal to 1600 sq ft?

9. The number, N, of bacteria per m^3, found in unchlorinated water depends on the temperature, T, in degrees celsius. If the number of bacteria is given by $N = 60T - T^2$, at what temperature will the number of bacteria exceed 500 units / m^3?

$500 < 60T - T^2$

$T^2 - 60T + 500 < 0$

$(T - 50)(T - 10) < 0$



b/w 10°C and 50°C

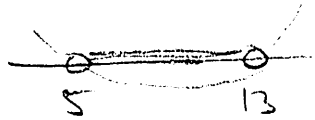
10. A window manufacturer projects that profit in dollars from making x windows per week will be $P(x) = -x^2 + 45x - 450$. How many windows per week must be manufactured to make a profit?

11. The average cost in dollars of producing x units of golf clubs is $x^2 - 18x + 140$. Determine the number of golf clubs to produce each hour to keep the cost below \$75 per club.

$x^2 - 18x + 140 < 75$

$x^2 - 18x + 65 < 0$

$(x - 13)(x - 5) < 0$



b/w 5 and 13 clubs/hr.

12. The profit for a construction company is $P(x) = -0.1x^2 + 50x - 5250$, where x is the total number of hours worked by the employees in a week. What total hours worked by the employees will produce a profit for the company?

13. The height in metres of a ball thrown upward from a building is $h(t) = -4.9t^2 + 29.4t + 24.3$, where t is the time in seconds after releasing the ball. During what time interval will the ball be above 40 metres?

$40 < -4.9t^2 + 29.4t + 24.3$

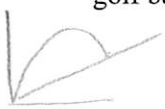
$4.9t^2 - 29.4t + 15.7 < 0$

$t = 0.59, 5.41$

b/w 0.59 second 5.41 sec.

14. The number of miles that a new electric-hybrid car can travel on one gallon of gas is related to its speed v in mph. If the distance can be determined by $M = -\frac{1}{20}v^2 + \frac{9}{2}v$, $0 < v < 100$, for what speeds will M be at least 40 mpg?

15. A golfer hits a drive up a hillside, in a trajectory given by $y = -0.0015x^2 + 0.5x$. The hillside has slope $\frac{1}{8}$. What are the landing coordinates of the golf ball in yards?



$y = \frac{x}{8}$

$y = -0.0015x^2 + 0.5x$

$\frac{x}{8} = -0.0015x^2 + 0.5x$

$0.0015x^2 - 0.375x = 0$

$0.0015x(x - 250) = 0$

$x = \cancel{0}, 250$

when $x = 250$, $y = \frac{250}{8} = 31.25$.

$(250, 31.25)$

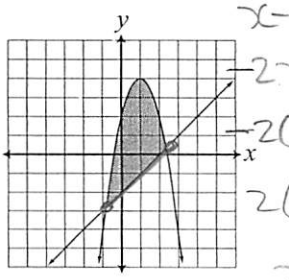
16. The price, p, in dollars of a product is given by $p(n) = 36 - 0.4n$, $0 \le n \le 90$, where n is the number of units sold each day. The operating cost of the business is \$100 per day, plus \$20 in commission for each item sold.

a) Find the daily revenue function.

b) Find the daily cost function.

c) If the profit function is given by $P(n) = R(n) - C(n)$, for what values of n will the profit be greater than or equal to zero?

17. Find the maximum vertical distance, d, between the parabola $y = -2x^2 + 4x + 2$, and line $y = x - 2$, for the shaded region.



$x - 2 = -2x^2 + 4x + 2$

$-2x^2 + 3x + 4 = 0$

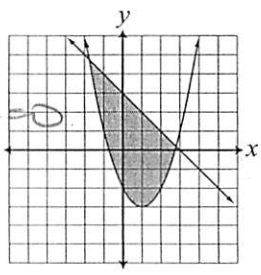
$-2(x^2 + \frac{3}{2}x + \frac{9}{16} - \frac{9}{16}) + 4 = 0$

$2(x + \frac{3}{4})^2 + \frac{9}{8} + 4 = 0$

$2(x - \frac{3}{4})^2 + \frac{41}{8} = 0$

$max = \frac{41}{8} = 5.125$

18. Find the maximum vertical distance, d, between the parabola $y = x^2 - 2x - 2$, and line $y = -x + 3$, for the shaded region.



7.6 Chapter Review

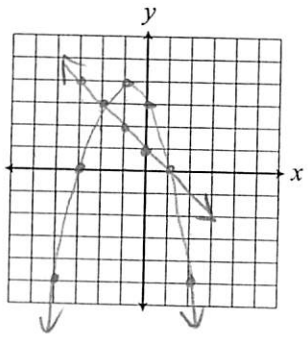
Section 7.1

1. Solve the system by graphing.

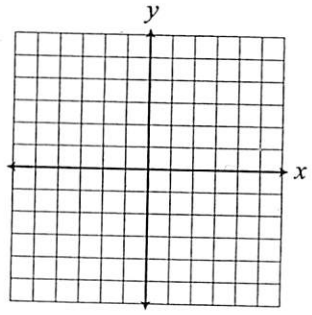
a) $y = -(x^2 + 2x) + 3$
$y = -x + 1$

$-(x+1)^2+4$

$(-2,3)\ (1,0)$

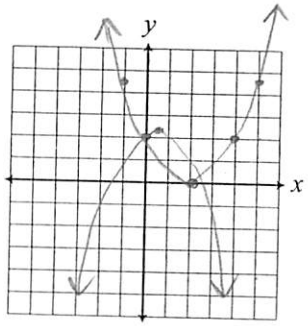


b) $y = x^2 - 3x - 4$
$2x + y = 2$

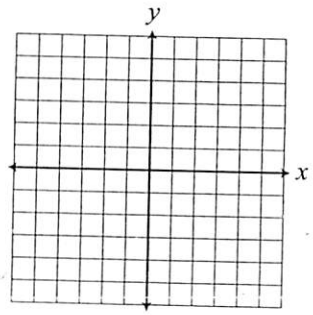


c) $y = \frac{1}{2}(x-2)^2$
$y = -x^2 + x + 2$

$-(x-\frac{1}{2})^2+\frac{9}{4}$



d) $y = x^2 - 2x - 3$
$y = -\frac{5}{3}x^2 - 2x + \frac{23}{3}$



Section 7.2

2. Find all real solutions.

a) $y = x^2 - 3$
$x + y = 3$

$x+(x^2-3)=3$
$x^2+x-6=0$
$(x+3)(x-2)=0$
$x=-3,2$
$y=(-3)^2-3=6$
$y=(2)^2-3=1$
$(-3,6)(2,1)$

b) $y = -\frac{1}{2}x^2 + 4$
$y = -2x + 6$

c) $y - x^2 = 3$
$y - x = 3$

$y=x^2+3$
$y=x+3$
$x^2+3=x+3$
$x^2-x=0$
$x(x-1)=0$
$x=0,1$
$y=0+3=3$
$y=1+3=4$
$(0,3)(1,4)$

d) $y = x^2 + 2$
$y = x - 2$

3. Find all real solutions.

a) $y = x^2 + 4$
$y = 16 - x^2$

$x^2 + 4 = 16 - x^2$

$2x^2 = 12$

$x^2 = 6$

$x = \pm\sqrt{6}$

$y = (\sqrt{6})^2 + 4 = 10.$

$(\sqrt{6}, 10)\ (-\sqrt{6}, 10)$

b) $y = x^2 - 2$
$y = -(x+2)^2$

c) $y = \frac{1}{2}x^2 - 3$
$y = -(x-1)^2$

$\frac{1}{2}x^2 - 3 = -(x-1)^2$

$\frac{1}{2}x^2 - 3 = -x^2 + 2x - 1$

$\frac{3}{2}x^2 - 2x - 2 = 0$

$3x^2 - 4x - 4 = 0$

$(3x+2)(x-2) = 0$

$x = -2/3, 2.$

$y = \frac{1}{2}\left(\frac{-2}{3}\right)^2 - 3 = -\frac{25}{9}$ $(-2/3, -25/9)$

$y = \frac{1}{2}(2)^2 - 3 = -1$ $(2, -1)$

d) $y = -(x+2)^2 + 6$
$x^2 + y = 4$

Section 7.3

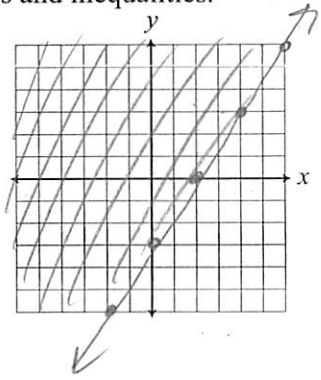
4. Graph the following systems and inequalities.

a) $\left[\frac{1}{2}x - \frac{2}{3}y \le 1\right]$ 6.

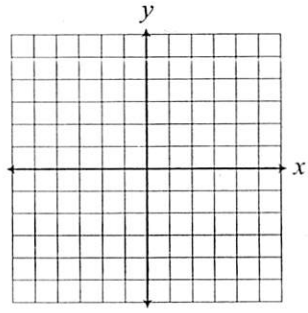
$3x - 2y \le 6$

$3x - 6 \le 2y$

$\frac{3}{2}x - 3 \le y$



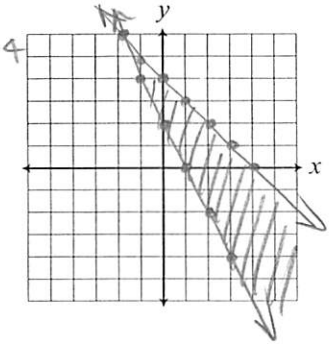
b) $\frac{1}{2}x + 0.2y < 1$



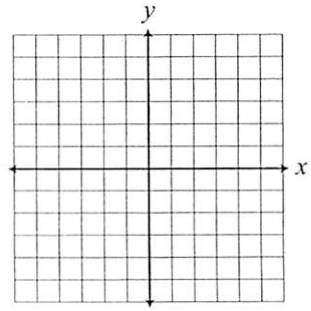
c) $x + y \le 4$
$2x + y \ge 2$

$y \le -x + 4$

$y \ge -2x + 2$



d) $2x + y \le 8$
$3x - 2y \le 12$
$x \ge 0$
$y \ge -4$

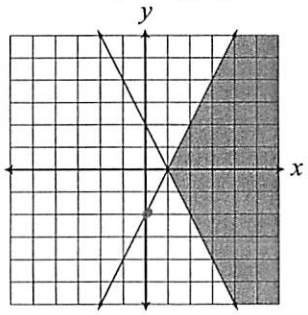


5. Write a system of inequalities for the given graph.

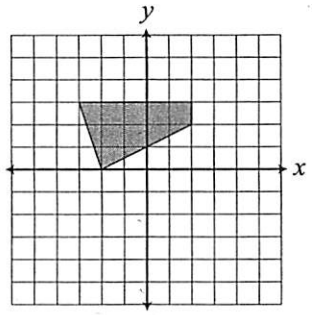
a)

$y \leq 2x - 2$

$y \geq -2x + 2$



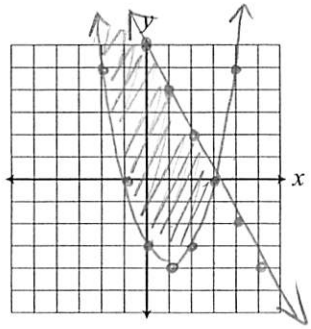
b)



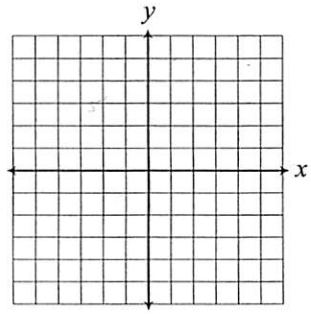
Section 7.4

6. Graph. $(x-1)^2-4$

a) $y \geq x^2 - 2x - 3$
$y \leq -2x + 6$

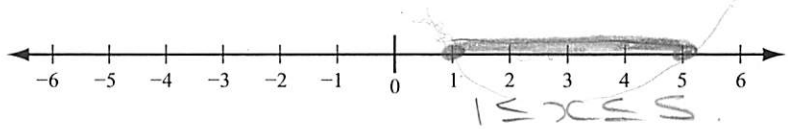


b) $y \leq -\frac{1}{2}(x-2)(x+3)$
$x - 4y \leq 4$



c) $x^2 - 6x + 5 \leq 0$

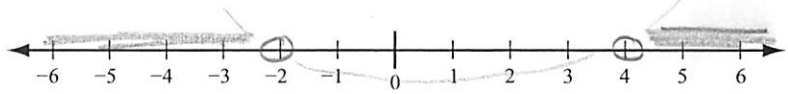
$(x-5)(x-1) \leq 0$



$1 \leq x \leq 5$

d) $x^2 - 2x - 8 > 0$

$(x-4)(x+2) > 0$



$x < -2$, $x > 4$

Section 7.5

7. The length of a rectangle is 2 metres more than the width, and the area is less than 63 square metres. What is the range of values for the width of the rectangle?

$w(w+2) < 63$

$w^2 + 2w - 63 < 0$

$(w+9)(w-7) < 0$

~~answer~~

-9 7

but width has to be +ve!

$0 < w < 7$

8. A baseball player hits a fly ball with trajectory $d = 64t - 16t^2$, with d, the distance above ground in feet at time t, in seconds. During what time interval is the ball above 48 feet in the air?